Localizing Operations in Parts

I noted earlier that sometimes researchers are able to make greater progress in identifying parts than in specifying operations, or vice versa. One reason this happens in the history of science is that the techniques for carrying out one form of decomposition are developed in a different field and at a different time than those for carrying out the other form of decomposition. We will see in subsequent chapters that this was often the case with regard to mechanisms in the cell. Biochemists, focusing on functional decomposition into component operations, identified biochemical reactions. Cytologists, focusing on structural decomposition into component parts, identified those organelles that were within the resolving power of their microscopes. It was engagement between these fields that gave rise to cell biology. Increasingly, parts and operations in what previously had been a terra incognita were identified and aligned to provide new mechanistic accounts (e.g., it was found that one part of the mitochondrion – its inner membrane – performed the operation of maintaining a key energy gradient). Equally important, it was learned which of the newly discovered mid-level structures housed which lower-level biochemical reactions. For example, the cytosol was found to be the site of the reactions involved in glycolysis. This kind of alignment, crossing levels rather than remaining at a single level, at the very least provided a more complete account of the cell. Often there were further benefits, as important hints and constraints suggested by interlevel alignments led to improved accounts at one or more of the levels involved. At various points in the chapters that follow, I use the term *localization* to refer not only to alignments within a single mechanism but also to those that crossed levels in the cascade of mechanisms being uncovered by cell biologists.

The ability to link operations with parts often depends upon developing experimental procedures that can provide appropriate linking information. In the case of cell biology, the ability of electron microscopy to identify the structures found both in whole cells and in preparations of working parts isolated by cell fractionation provided the primary evidence relating biochemical operations with the organelles of the cell. As discussed in Chapter 4, an important contribution of such connections is that they provide a means of corroborating each decomposition. Linking a component operation with an independently identified component part provides evidence that both really figure in the mechanism. Failure to link operations with parts, on the other hand, can be grounds for doubting the existence of either the part or the operation. As we shall see, cell organelles were often claimed to be artifacts until they were shown to be the locus of important operations in the cell. Linking an